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ABSTRACT

The purpose of this investigation was to study the effect of controlling the letters used in words both for a training program designed to improve visual discrimination and for a word recognition task. The experiment was designed to investigate the influence of simultaneous and successive discrimination learning with stimuli which varied in stimulus similarity. Words were controlled for meaningfulness to explore whether familiarity with a word will lessen the possible effect that confusable letters may have on the perception of a word. Four types of distractor errors appeared in the words used with matching procedures in order to gain information about the cues which children use to match words. Subjects for the study were 120 kindergartners, ranked according to reading readiness test scores and labeled as low, middle, and high. Each subject was taught six meaningful and six nonmeaningful words in two separate sessions. The results indicated, among other things, that the choice of matching procedures influenced word matching scores without consideration of the letter confusability factor. Simultaneous procedures with nonmeaningful words were superior to successive for the low, middle, and high reading readiness groups. Simultaneous matching with meaningful words was better only for the low reading readiness group. (LL)

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Kindergarten Children And The Influence Of Letter Shapes And Meaningfulness Of Vocabulary As Factors Influencing Word Recognition

Dr. Bette G. Leeds

Purpose

Recent investigations (Marchbanks and Levin, 1965; Timko, 1970) suggested that children use letters as the salient cues for word recognition. It seems probable that if children rely on individual letters as cues, the characteristics of the letters may affect the facility with which beginners discriminate words. The purpose of this investigation was to study the effect of controlling the letters used in words both for a training program designed to improve visual discrimination and for a word recognition task. Letters were categorized as confusable if they appeared on the Popp (1964) and Smith (1928) lists of the 11 most confusable letters. The experiment was designed to investigate the influence of simultaneous and successive discrimination learning with stimuli which varied in stimulus similarity. Words were controlled for meaningfulness to explore whether familiarity with a word will lessen the possible effect that confusable letters may have on the perception of a word. Four types of distractor errors appeared in the words used with matching procedures, in order to gain information about the cues which children use to match words. Subjects for the study were 120 kindergartners, ranked according to reading readiness test scores and labeled as low, middle and high. A table of random numbers was used to select and assign randomly selected kindergartners to experimental procedures. Each

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subject was taught 6 meaningful and 6 nonmeaningful words in two separate sessions. There was a total of 6 word learning scores for each participant.

Results

1) The choice of matching procedures influenced word matching scores without consideration of the letter confusability factor. Simultaneous procedures with nonmeaningful words were superior to successive for the low, middle and high reading readiness groups. Simultaneous matching with meaningful words was better only for the low reading readiness group.

2) Words composed of nonconfusable letters were matched with greater success than words composed of confusable letters only for words in the nonmeaningful word category.

3) The majority of the errors with the visual distractors occurred in the middle and final portions of words. Differences in degrees of reading readiness affected the variety and frequency of errors.

4) With consistency, membership in a reading readiness group determined word learning success.

5) Letter confusability contributed significant effects to word learning only in the meaningful word category.

6) The differential effect on word recognition of simultaneous and successive visual discrimination procedures in respect to the letters which composed the words was slight. With nonmeaningful words, simultaneous procedures were more effective than successive with words composed both of confusable and nonconfusable letters, for only one word learning measure. With meaningful words, there

was evidence of an interaction among reading readiness group, letter confusability and matching procedures for just one word learning measure.

7) The mean measures for meaningful words were consistently superior to the measures for nonmeaningful words.

Conclusions

1) Success with matching procedures prior to word learning is influenced by the choice of procedures. With relative consistency, simultaneous matching is superior to successive.

2) The transfer effects of a visual discrimination program to word learning depend upon the choice of matching procedures, reading readiness group and measures used to evaluate word recognition.

3) Although the findings were not consistent, it seems likely that letters function as cues and words composed of nonconfusable letters are easier to discriminate and read than words composed of confusable letters.

4) A study of the distractor errors suggested that letters in the initial position are the most frequently used letter cues.

5) The meaningfulness of words facilitates their recognition and seems to affect the perception of letters.

6) The ability to read words did not correlate highly with visual discrimination. Most likely, facility with word recognition requires abilities in addition to visual discrimination skill.

7) The measure for the rate of learning to read meaningful and nonmeaningful words correlated highly with four other measures for word learning. It can be inferred that the speed with which one learns to read words is an important component of a general facility for word recognition.

KINDERGARTEN CHILDREN AND THE INFLUENCE OF LETTER SHAPES AND MEANINGFULNESS OF VOCABULARY AS FACTORS INFLUENCING WORD RECOGNITION

[redacted]

PURPOSE

Words must be discriminated before meanings can be attached to them. Studies by Cattell (cited by Huey, 1920) are often quoted to justify the whole word method as the fundamental unit of recognition. The recent investigations conducted by Marchbanks and Levin (1965); Timko (1970) and Williams, Blumberg and Williams (1970) suggested that children use letters as the salient cues for word recognition. Fundamental to understanding the beginner's perceptual process of word recognition is whether begineers see the visual stimuli as adults see familiar word patterns, as adults see unfamiliar word configurations, or possibly in yet some other manner. It seems probable that if children rely on individual letters as cues, the characteristics of the letters may affect the facility with which beginners discriminate words. Popp (1964) and Smith (1928) reported that certain lower case letters were more difficult to match than others, and their findings were in substantial agreement. The purpose of this investigation was to study the effect of controlling the letters used in words both for a training program designed to improve visual discrimination and for a word recognition task. Letters were categorized as confusable if they appeared on the Popp and Smith lists of the 11 most confusable letters. The focus of the study was on kindergarten pupils who scored low, middle and high on

a standardized test of the ability to match letters and words to see if words composed of nonconfusable letters would be easier to match and read than words composed of confusable letters. Lack of knowledge of how IQ interacts with visual discrimination ability suggested the need to control for intelligence.

It is not clear how the influence of meaning interacts with verbal symbols and whether familiarity with a word will lessen the possible effect that confusable letters may have on the perception of the word. Previous studies devoted to factors which influence word recognition either controlled for meaningfulness by utilizing nonsense syllables or used meaningful words to study similar factors without controlling for the effect that meaning has on these factors (Davidson, 1934; Marchbanks & Levin, 1965; Timko, 1970). Therefore, the words in the study were controlled for meaningfulness.

Concern has been given to improving ability in visual discrimination through reading readiness training programs. When words in a training program contain letters which are inversions and rotations of other letters, the resultant similarities may lead to "generalizations" of perceptual confusion, which do not allow the stimuli to assume the distinctive qualities prerequisite to visual recognition (Gibson, 1940). It seems likely that an adjustment of simultaneous and successive matching procedures to qualities of the visual stimuli may affect the perception of the distinguishing features of the stimuli.

The following null hypotheses were proposed:

1. If words are recognized as total configurations, the acquired distinctiveness of cues will be of geometric patterns. Thus for meaningful

and nonmeaningful words there would be no difference in the number of word pairs matched following the use of either

a. simultaneous or successive procedures, when words contain confusable letters, or

b. simultaneous or successive procedures, when words contain nonconfusable letters.

2. If words are recognized as total configurations, there is no difference in the scores for the learning of

a. meaningful words composed of confusable or non-confusable letters;

b. nonmeaningful words composed of confusable or non-confusable letters.

3. If words are recognized as total configurations, and letters do not serve as cues to word recognition, there is no difference in the transfer effects on learning to read between

a. simultaneous and successive matching procedures for meaningful words, and

b. simultaneous and successive matching procedures for nonmeaningful words.

4. There are no differences in the word learning measures between meaningful and nonmeaningful words.

In addition, the distractor errors made in matching words were tabulated to determine differences among the reading readiness groups in terms of cues used to match words.

METHODOLOGY

Materials

Instruments

The Slosson Intelligence Test for Children and Adults, 1971 edition; the Lee-Clark Reading Readiness Test, 1962 revised edition.

Stimuli

The visual discrimination training exercises and the word learning program were employed in a small pilot study, in order to refine experimental procedures.

Twenty-four words were typed in primer, lower case letters on 3 x 5 cards and sealed in plastic for protection. The words were controlled for length and differed in confusability of letters and meaningfulness. Twelve words contained three out of four of the letters which appeared on the Popp (1964) and Smith (1928) lists and were defined as words which may be confused because of the letters they contain. The remaining 12 words were composed of letters which did not appear on the Popp and Smith lists and were labeled nonconfusing words. Twelve words were selected from the vocabularies in the preprimers of Scott Foresman, 1963 edition, and Ginn, 1961 edition, 12 words did not appear in the preprimers and were chosen to serve as nonmeaningful stimuli. In pretraining screening procedures the words were evaluated for meaningfulness and nonmeaningfulness. Twenty-four words, grouped for meaningfulness and letter confusability, were arranged in four sets of six words each, in a prescribed order for the initial word learning program.

The words used in the visual discrimination training program were the same as those employed in the word learning program. However, they were presented on cards different from those used in the word learning matching exercises. Four types of distractors were employed in order to gain information about the visual cues which children use to match words. The distractors had the following characteristics:

1. The first two letters were the same as the first two letters in a stimulus word; the order of the final two letters was reversed.
2. The order of the letters of the stimulus word was completely reversed.
3. The initial and final letters of the stimulus word were maintained, the middle letters were in reverse order.
4. The order of the first two letters was a reversal of the order of the beginning letters of the stimulus word; the last two letters were maintained.

Sampling and Grouping Procedures

One hundred twenty kindergartners who resided in an upper middle class suburb of New York City comprised the sample. They had an average chronological age of five years, three months and attended three elementary schools.

The Slosson Intelligence test for Children and Adults was administered individually to all the kindergartners in early September and October, 1972. The Lee-Clark Reading Readiness Test was administered

individually to the same pupils in late October and November, 1972. Greater homogeneity of the sample was achieved by eliminating potential subjects when their test measures fell either in the highest or lowest 10 percent of the Slosson Intelligence Test measures for this group and/or the highest or lowest 5 percent on the Lee-Clark Reading Readiness Test measures. One hundred seventy-six kindergartners were ranked according to their reading readiness test scores. The 59 kindergartners who attained the highest reading readiness test scores were labeled the high reading readiness group; the 59 subjects who received the lowest reading readiness test scores were identified as the low reading readiness group; the remaining 58 kindergartners were designated the middle reading readiness group. A table of random numbers was used to select and assign 40 randomly selected students from each reading reading readiness group to either simultaneous or successive matching. Each subject was exposed to both six meaningful and six nonmeaningful words, in separate periods. Each subject was randomly assigned to learn words which were comprised mainly of confusable or mainly of nonconfusable letters.

Pretraining Screening

1. Determination of meaningfulness of words according to a criterion of ability to define or use the words in a sentence.
2. Ability to read the words at sight.
3. Concept of "same" or "alike."

Experimental Procedures

Visual Discrimination Training

Individual sessions, for each child, were spaced about four weeks apart. Six stimulus word cards were presented in a prescribed order. The kindergartner was given eight pairs of word cards, one pair at a time, in a prearranged order, to match to the same stimulus before he was presented with a new model and another group of eight cards. Kindergartners were randomly assigned to direct matching (simultaneous) or delayed matching (successive) procedures.

The visual discrimination training scores consisted of one point for each pair of cards matched correctly; no partial credit was allowed. Six seconds were allowed to match each pair. If a subject seemed frustrated, as evidenced by such physical signs as nail biting or finger playing, the examiner proceeded to the next stimulus.

Word Learning

Immediately following the visual discrimination training sessions, the kindergartners were taught to read the words they had matched. The investigator displayed a word card in front of the kindergartner. The subject was instructed to look at the word while the examiner read it. The investigator waited five seconds and then proceeded to the next word in the prescribed order. This procedure was followed two consecutive times. Then, the word cards were arranged in random order and presented eight times. The subject was instructed to attempt to identify the word after each presentation. The examiner either reinforced a correct response with the statement: "Yes this is . . . ." With an incorrect

response she said, "No this is . . . " or stated the word when the subject did not respond. There were eight learning trials for each word. The measures for word learning consisted of

a. the number of words a kindergartner was able to read correctly a minimum of one time;

b. the number of trials required to learn to read a word correctly at least one time;

c. the number of words the kindergartner read correctly during the final two learning trials.

Since every subject was taught six meaningful and six nonmeaningful words in two separate sessions, there was a total of six word-learning scores for each participant.

Statistical Treatment

A 2 x 2 x 3 factorial analysis of variance (ANOVA) design with each of the dependent variables was utilized for the three independent factors: reading readiness, types of matching procedures, letter confusability. If the interaction was statistically significant, an analysis of simple main effects was computed (Winer, 1973). The Tukey (T method) was followed if the main effects were statistically significant with nonsignificant interactions. A pooled within group t test for paired data was used to compare the data for meaningful and nonmeaningful words for each of the dependent variables. To show the correlation among the measures for visual discrimination, reading readiness, IQ, and word recognition, a matrix of pooled within group correlations was calculated.

Results

1. The data accumulated for matching procedures, letter confusability and reading readiness for meaningful and nonmeaningful words supported the first hypothesis of the study. The choice of matching procedures influenced word matching scores without consideration of the letter confusability factor. Simultaneous procedures with nonmeaningful words were superior to successive for the low, middle and high reading readiness groups. Simultaneous matching with meaningful words was better only for the low reading readiness group.

2. Words composed of nonconfusable letters were matched with greater success than words composed of confusable letters only for words in the nonmeaningful word category.

3. An examination of the data for visual distractors indicated that the majority of errors occurred in the middle and final portions of words. Differences in degrees of reading readiness affected the variety and frequency of errors. The least frequent source of matching errors occurred when the initial two letters were reversed in the four letter words.

4. With consistency, the degree of reading readiness achieved seemed to determine word learning success. Although the differences between the middle and high reading readiness groups were statistically nonsignificant, their performance was better than the word learning ability of the low group.

5. Letter confusability contributed significant effects to word learning only in the meaningful word category. These differences, however,

were not consistent. When words were scored for number read correctly one time, there were nonsignificant differences between the mean number of confusable and nonconfusable words read but significant differences when the discrimination procedures and reading readiness were taken into account. For number of meaningful words read correctly during the final two learning trials, words composed of nonconfusable letters yielded significantly better word learning scores than words composed of confusable letters.

6. The differential effect on word recognition of simultaneous and successive visual discrimination procedures in respect to the letters which composed the words was slight. With nonmeaningful words, simultaneous procedures were more effective than successive with words composed both of confusable and nonconfusable letters, for only one word learning measure. With meaningful words, there was evidence of and interaction among reading readiness group, letter confusability and matching procedures for just one word learning measure.

The second hypothesis was not rejected for the six word learning measures. Hypothesis three was not rejected for five out of six word learning measures and was rejected for reading meaningful words one time.

7. The data accumulated for meaningful and nonmeaningful words does not support hypothesis four. The mean measures for meaningful words were consistently superior to the measures for nonmeaningful words.

Conclusions

1. The degree of reading readiness achieved seems to determine word matching and word recognition success. Even though the kindergartners

had an average IQ of 120, members in the low reading readiness group were not able to compensate for their poor visual discrimination ability, and this factor seemed to affect their ability to match and read words taught by the Look-Say method.

2. Success with matching procedures prior to word learning is influenced by the choice of procedures. With consistency, if the procedure does make a significant differences, simultaneous matching is superior to successive.

3. The transfer effects of a visual discrimination program to word learning depend upon the choice of matching procedures, reading readiness group and measures used to evaluate word recognition.

4. Although the findings were not consistent, it seems likely that letters function as cues and words composed of nonconfusable letters are easier to discriminate and read than words composed of confusable letters.

5. A study of the distractor errors suggested that letters in the initial position are the most frequently used letter cues.

6. The meaningfulness of words facilitates their recognition and seems to affect the perception of letters.

7. The ability to read did not correlate highly with visual discrimination. Most likely, facility with word recognition requires abilities in addition to visual discrimination skill.

8. The ability to read meaningful words correlated highly with the ability to read nonmeaningful words, which suggests the presence of a general facility for word recognition.

9. The measure for the rate of learning to read meaningful and nonmeaningful words correlated highly with four other measures for word learning. It can be inferred that the speed with which one learns to read words is an important component of a general facility for word recognition.